

Kaufman - Trading Systems & Methods - Chap15

Chap15

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15 Pattern Recognition

Pattern recognition forms the basis for most trading systems. It is most obvious in traditional charting, which is entirely the identification of common formations even moving averages attempt to isolate, using mathematical methods, what has been visually determined to be a trend. Traders have always looked for patterns in price movement. Because they were not equipped with computers, their conclusions are considered market lore rather than fact and are handed down from generation to generation as proverbs, such as "Up on Monday, down on Tuesday" "Locals even up on Fridays and "Watch for key reversals." Because these three sayings have endured, they are candidates for analysis later in this chapter.'

The earliest technical systems based on patterns were of the form: If after a sharp rise the market fails to advance for 3 days, then sell. As computers became more powerful, more complex approaches could be taken. For example, by observing the closing prices starting on an arbitrary day, all patterns of higher and lower closes can be recorded to find their tendency to repeat. A computer is well equipped to perform this task. First, the 2 and 3 day patterns are eliminated because the recurrence of updown or downup and the equivalent 3 day patterns would be too frequent to be meaningful. Then, the closing prices are scanned for occurrences of predefined patterns. For example, if an upupdownup downup is to be matched, every six consecutive prices must be tested. From a table of occurrences we can conclude that these patterns can be predicted in advance or that they are leading indicators of other price moves. This approach, as well as the combination of events used to forecast profitable situations, are discussed later in this chapter.

Pattern recognition may appear to be more of a game than a business, but it is a source of many valuable ideas. Figure 151, a graph of the New York Stock Exchange (1854-1959), shows the simplification of patterns to the point where it is difficult not to count the recurrences of the more obvious patterns and look for the formations that precede them to see whether they could be predictive. For example, in 1922, 1924, and 1927 there were sharp advances in the market.' the years preceding those showed an identical U pattern. It would be interesting to see whether another occurrence of a symmetric U was followed by a similar rise. Another pattern that stands out is that of two consecutive years of sharp rise. 1862-1863, 1908-1909, 1918-1919, and 1927-1928; in no case was there a third consecutive year, but neither the preceding nor following years seem consistent.

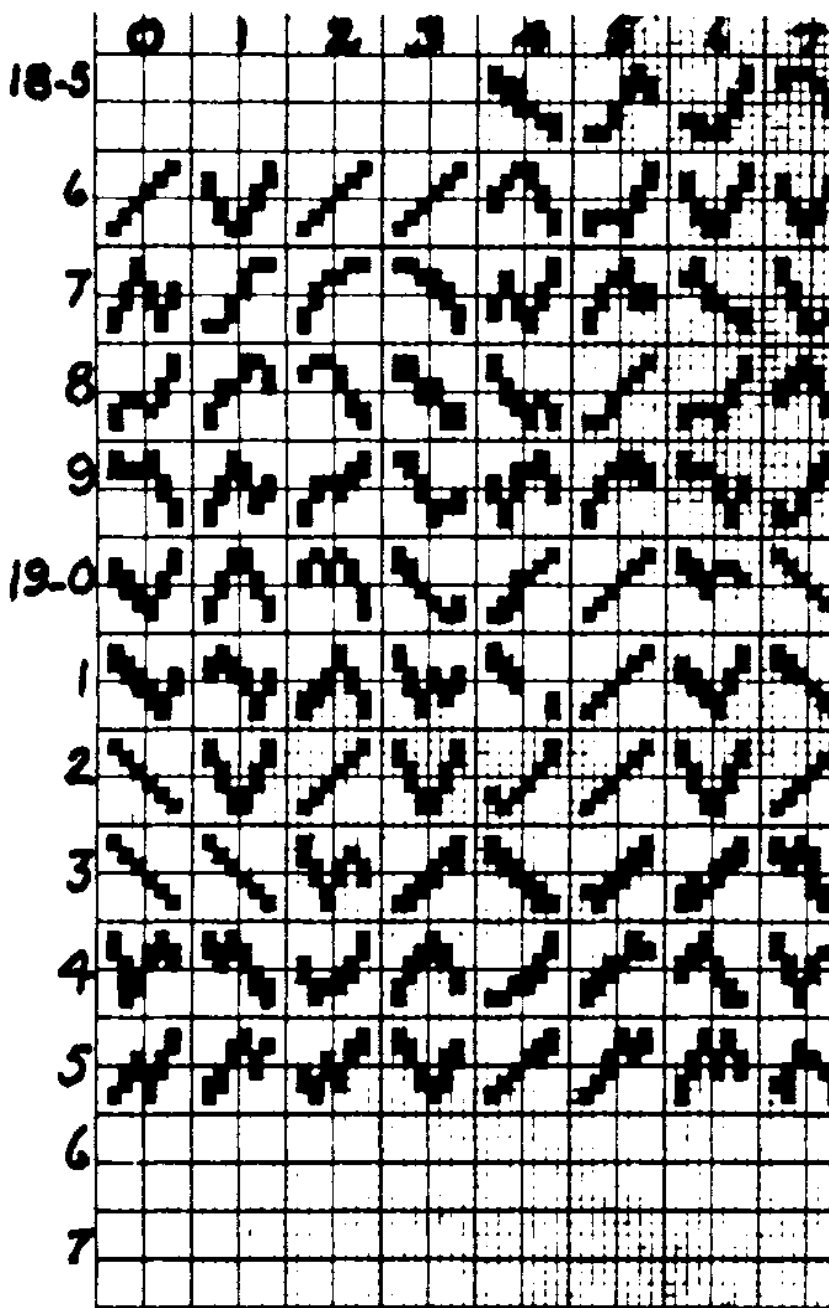
Patterns frequently provide the foundation for a trading method or the justification for beginning work in the development of a method. They have been applied in many ways to price analysis, from the time of day to place an order to the compound relationship of price, volume, and open interest. Daily trading opportunities may be a function of patterns based on the strength or weakness of the daily opening price. These are discussed in the next section. Weekly and weekend traits are studied, as well as types of reversals and their effects. These techniques can be considered

complementary when used sequentially, or they can confirm the results of another test when used together. The end of this chapter discusses more general issues in pattern recognition.

¹The only other known work that concerns similar patterns, although for the stock market, is by Arthur A Merrill, *Behavior of prices on Wall Street* (Analysis Press, Chappaqua, NY 1966).

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FIGURE 15 1 Graph of the New York Stock market.



PROJECTING DAILY HIGHS AND LOWS

Statisticians claim that the best forecast of tomorrow's price is

today's price; they state that no one has been able to reliably account for all the factors that would be needed to accurately project the changes that result in the high and low prices for tomorrow. Nevertheless, many traders project these values and seem to use them with success.

PivotTechnique

The simplest approach to projecting tomorrow's highs and lows is to base those figures on the average price of today plus or minus a value that somehow relies on the current trading range, or volatility. One technique, based on a pivot point, projects two levels of support and resistance:

Pivot point	$P = (H + L + C)/2$
Resistance 1	$R1 = 2 \times P - L$
Support 1	$S1 = 2 \times P - H$
Resistance 2	$R2 = (P - S1) + R1$
Support 2	$S2 = P - (R1 - S1)$

DeMark's Projected Ranges

Another author and trader, Tom DeMark,³ has based his projections on the positioning of today's opening price relative to yesterday's closing price, which gives him added timeliness.

³Mark Etzkorn, "AD in a day's work," *Futures* (January 95). This technique is attributed to William Greenspan.

³ Tom DeMark, *The New Science of Technical Analysis* (John Wiley & Sons, New York, 1994).

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information. If today's open is higher than the previous close, the projections are biased upward; if lower than the close, they are biased downward.

1. If today's close is below today's open, then

Tomorrow's projected high = $(H + C + 2 \times L)/2$

Tomorrow's projected low = $(H + C + 2 \times L)/2$

2. If today's close is above today's open, then

Tomorrow's projected high = $(2 \times H + L + C)/2$

Tomorrow's projected low = $(2 \times H + L + C)/2$

3. If today's close is the same as today's open, then

Tomorrow's projected high = $(H + L + 2 \times C)/2$

Tomorrow's projected low = $(H + L + 2 \times C)/2$

Once the basic formula is determined, biasing tomorrow's projection in the direction of today's close relative to today's open, then the projected high is found by removing two units of the low price, and the

projected low is found by removing two units of the high price from the formula. This effectively shifts the projection in the direction of the new high by onehalf the difference of today's close and today's low, $(C - L)/2$, and the new low by onehalf the difference of today's close and today's high, $(H - C)/2$.

Comparing the Two Ranges

Because the two methods, the pivot point technique and projected ranges, use the same basic prices, combining them with simple multiples, it is not clear whether the results give values that are the same or different. For example, if the Deutschemark had a high, low, and close of 6600, 6450 and 6500, the first pivot method would give a projected first resistance level (high) of $2 \times (6600 + 6450 + 6500)/3 - 6450 = 6583$. DeMark's projected high is different based on how today's opening price relates to the previous close. If the open is lower than the previous close, we get $(6600 + 6500 + 2 \times 6450)/2 - 6450 = 6550.1$ if the open is higher, we have $(2 \times 6600 + 6450 + 6500)/2 - 6450 = 6625$; and if the open is about the same as the previous close, then the projected high is $(6600 + 6450 + 2 \times 6500)/2 - 6450 = 6575$. It seems reasonable that the pivot point method returns a value close to DeMark's neutral case, when the market opens unchanged from the previous close.

TIME OF DAY

Market participants, especially floor traders, are the cause of periodic movement during the day. Angas called these the "tides of the daily prices." Over the years, the great increase in participants has added liquidity to each pit but has not altered the intraday time patterns.

There are a number of reasons for the regular movement of prices. Because most of the daily volume is the result of day trades, those positions entered in the morning will be closed out by the afternoon to avoid the need for the margin required of positions held overnight. Orders that originate off the floor are the result of overnight analysis and are executed at the open. Scalpers and floor traders who hold trades for only a few minutes frequently have a midmorning coffee break together; this natural phenomenon causes liquidity to decline and may result in a temporary price reversal. All traders develop habits of trading at particular times. Some prefer the opening, others 10 minutes after the open. Large funds and managed accounts will have a specific procedure for entering the market, such as using closeonly orders.

A day trader must watch certain key times. The opening moments of trading are normally used to assess the situation. A floor trader will sell a strong open and buy a weak one; this means the trade must be evened up later and thus reinforces the opening direction. On a strong open without a downward reaction, all local selling is absorbed by the market and later attempts of the locals to liquidate will hold prices up. In any event, floor trades

can be expected to take the opposite position to the opening direction, usually causing a reversal early in the session.

Tubb's Stock Market Correspondence Lessons, Chapter 13, explains the

dominant patterns in the stock market (given a 10:00 A.M.to3:00 P.m. session).

1. If a rally after the open has returned to the opening price by 1:00, the day is expected to close weaker.
2. if the market is strong from 11:00 to 12:00, it will continue from 12:00 to 1:00.
3. If a reversal from 1:00 to 1:30 finds support at 1:30, it will close strong.
4. If the market has been bullish until 2:00, it will probably continue until the close and into the next day.
5. A rally that continues for 2 or 3 days as in (4) will most likely end on an 11: 00 reversal.
6. in general, a late afternoon reaction down after a strong day shows a pending reversal.

Putting these together, the following patterns (among others) can be expected:

1. A strong open with a reversal at 11:00 not reaching the opening price, then strength from 11:00 to 1:00, a short reversal until 1: 30, and then a strong close; according to (5), another strong open the following day.
2. A strong open that reverses by 11:00, continuing lower until 1:00, reverses again until 1:30, and then closes weak.

Merrill's work shows the hourly pattern of the stock market in Table 151. The grid clearly indicates a bullish bias with 1963 the most obvious. The pattern is uniform and similar to what would be expected: early trending, an adjustment, then a wave of downupdown. Contrary to commodities, these 4 years show extremely consistent strength on the opening with a selloff on the close. Commodity prices may have regular patterns, but these patterns will occur with downward moves as well as upward ones. It is just as likely to see an opening selloff with a rally on the close.

For commodities, the patterns are similar but may be compacted, as in the case of agricultural products, due to shorter, earlier hours (9:30 A.M. to 1:15 P.m. for most Chicago grains and livestock), or shifted as with currencies that open earlier. Knowing the daily time patterns would not only help a day trader but would also aid any speculator to enter an order at a better place. Figure 152 shows the time pattern for the Chicago Mercantile Exchange live cattle contract (open from 9.05 A.M. to 12:45 P.m.). Seventysix consecutive trading days were tabulated for the June 75 contract from February 1 through May 31, 1975, an active period for cattle. The left scale of the chart shows the frequency of occurrences and the bottom shows the time of day. A line appearing in the top half of the chart indicates price movement in the direction of the opening price (from the prior close); the lower half shows a reversal trend. Measurements were first taken every 5 minutes and later every 15 minutes, due to a more variable price direction near the open.

TABLE151 Merrill's Hourly Stock Market Patterns

Time during Trading Session

	10:00	11:00	12:00	1:00	2:00	3:00
1962	-	+	-	-	+	-
1963	+	+	+	+	+	-
1964	+	+	-	-	+	-
1965	+	+	-	-	-	-

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Figure 152 shows that followthrough in the direction of the opening price slows down immediately and by 9:30, 25 minutes after the open, the price direction has usually reversed. There is a subsequent steady change in direction back and forth throughout the day. This pattern is remarkably similar to Merrill's stock market observations.

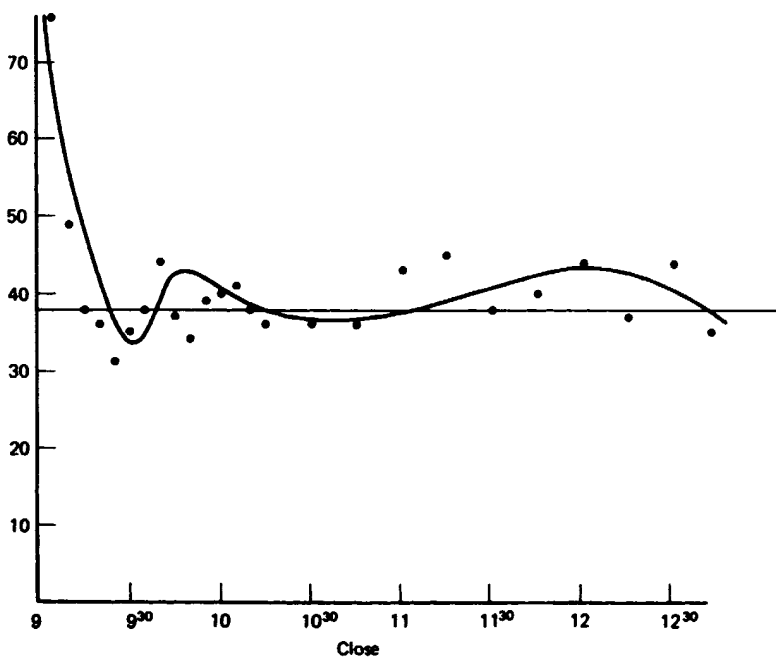
By showing two consecutive days of cattle price movement, Table 152 demonstrates how the data was accumulated. Although the table actually used 5minute intervals from 9:00 to 10: 15 and then 15minute intervals from 10: 15 until the close at 12:45, Table 152 is summarized in halfhour increments. If Friday's closing price was 45.00, Monday's open of 45.15 was indicated by a "+" for absolute direction and an 0 for opening direction. Any halfhour interval showing a price rise was marked with the relational symbol 0 and a reversal with an X. Tuesday opened lower, but the opening direction is still given as an 0. Every interval that followed with lower prices is in the opening direction and is marked 0. Adding the 76 test days together resulted in the scores shown in Table 153.

Knowing the direction of the price movement does not mean that trading these intervals will be profitable. To evaluate the potential, it is necessary to know the approximate size of the price move; the interval can then be selected with the greatest potential for movement in the direction of the timeofday pattern. By observing Figure 152, the intervals to study can be picked from the tops and bottoms of the cycles:

Selected Time Intervals

- a. Opening to 9:20
- b. 9:20 to 10:00
- c. 10:00 to 11:00
- d. 9:20 to 11:00
- e. 9:20 to 12:00
- f. 12:00 to closing

FIGURE 152 Intraday time patterns, June 75 cattle.



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TABLE 152 Accumulating TimeofDay Data

	Time	Price	Direction from Last	Direction from Open
<i>Monday</i>				
9:05	(1)	45.15	+	O
9:30	(2)	45.25	+	O
10:00	(3)	45.10	-	X
10:30	(4)	45.05	-	X
11:00	(5)	45.20	+	O
11:30	(6)	45.30	+	O
12:00	(7)	45.40	+	O
12:30	(8)	45.30	-	X
<i>Tuesday</i>				
9:05	(9)	45.25	-	O
9:30	(10)	45.35	+	X
10:00	(11)	45.45	+	X
10:30	(12)	45.40	-	O
11:00	(13)	45.50	+	X
11:30	(14)	45.40	-	O
12:00	(15)	45.20	-	O
12:30	(16)	45.05	-	O

For each interval, the average range from high to low (volatility) and the net result of this span (additive bias) were measured without considering the relative direction that was used to create the curve of time patterns. The results, shown in Table 154, indicate that the narrowest ranges, (b) and (c), were early in the day moving only a total of 14 points. The combined period (d) was 21.7 points, 50% greater than the individual periods (b) and (c). Figure 153 describes the likely combination of the intervals.

The results show a midmorning drift that nets a total of 4.6 points in the direction of the opening price, and a maximum potential profit of 21 points by entering a position between 9:20 and 10:00 and then liquidating between 10:00 and 11:00. During the test period, the magnitude of the cattle move did not appear worth the risk, but the same pattern might be profitably traded in a market with higher value per point.

When trying to find other market patterns, it might be best to observe only stronger or weaker openings. For example, a gap open of 5 to 20 points in cattle would indicate a potentially more volatile day allowing greater price reactions. More uniform results can be expected as seen in both the reversal patterns and gap analysis, which appear later in this

TABLE 153 Time Reversal Patterns*

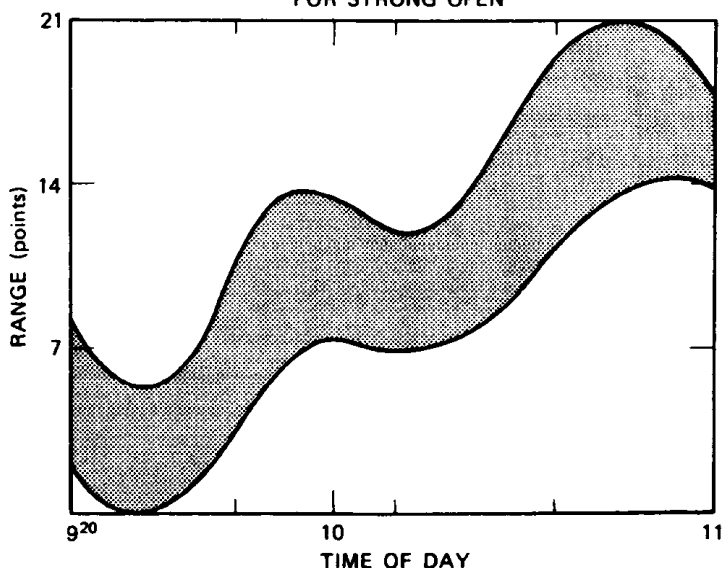
9:05	76	9:35	38	10:05	35	11:05	11
9:10	27	9:40	32	10:10	38	11:10	11
9:15	38	9:45	39	10:15	40	11:15	11
9:20	40	9:50	42	10:30	40	11:20	12
9:25	45	9:55	37	10:45	40	11:25	12
9:30	41	10:00	36	11:00	33	11:30	12

*A more recent look at June 1976 cattle showed very similar results.

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FIGURE 153 Cattle price ranges, 9:2011:00 A.M.

COMBINED RANGES (b) and (c)
FOR STRONG OPEN



chapter. Restricting trading to days of higher volatility will reduce the trading opportunities but improve results.

Trading the Early Patterns

The best opportunity for trading against the trend would be 5 minutes after the open. The opening momentum that carries prices further in the opening direction can be used to advantage without waiting. After 20 or 30 minutes, the opening reversal should have occurred, and a trade may be entered in the same direction as the opening but at a more favorable price.

Relating the Opening Trade to the Prior Day

Another analysis performed on the time pattern chart was a

correlation to determine whether the period from market open to 9:20 (15 minutes), related to the prior day's direction, could help predict the direction of the tides during the current day. The 15minute interval was chosen as sufficient time to react to results and place an order. The two situations distinguished were the relationship of the first trade to the prior day's direction and the direction of the early trading, using the first 15 minutes. Because the same 76

TABLE 154 Summarized Time Data

<i>Time</i>	<i>Average Volatility</i>	<i>Additive Bias</i>	<i>Points Moved in Direction of Open</i>
a. Open-9:20	17.3	+4.9	+4.4
b. 9:20-10:00	14.3	+1.5	+6
c. 10:00-11:00	14.2	+3.7	+3.9
d. 9:20-11:00	21.7	+5.3	+4.6
e. 9:20-12:00	25.8	+7.2	+3.3
f. 12:00-Close	19.6	+3.2	-1.2

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days of cattle trading were used, it should be noted that the conclusions are based on a small sample. Even though they are believed to be valid, there should be some variation between these results and those based on a large sample.

Four cases were observed using the time intervals shown in Table 155. The percentages are calculated as the likelihood of movement in a specific direction relative to the conditions of the opening price and opening interval:

1. The opening price continued in the same direction as the prior day's opentoclose direction.
2. The opening 15minute interval was consistent with the direction of the opening price as in (1).
3. The opening price and opening interval both continued the direction of the prior day.
4. The opening price and opening interval both continued opposite to the direction of the prior day.

Note that most of the intervals observed moved opposite to the opening price direction. This will support the more extensive work in the tables of reversal patterns and gap analysis. The two most extreme entries are the 39% in (1) and the 35% in (3). The first shows that by 9:20 there have been reversals 61% of the time, further supporting the previous conclusions. The second case, in (3), shows that an opening price and opening interval that continues in the direction of the prior close has reversed 65% of the time in the 10:00to1 1:00 A.M. interval.

Highs and Lows of the Day

In selecting a place to enter the market for a singleday trade, it would be a great advantage to know the time of day at which the highest or lowest price is likely to occur. To understand this, Figure 154 presents a

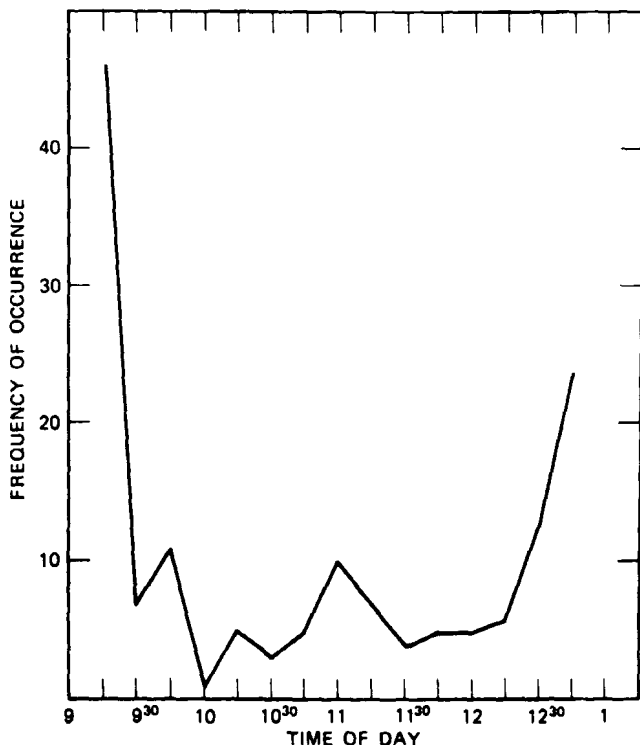
combined tabulation of both the daily highs and lows positioned at the time they occurred. The pattern clearly indicates that the opening and closing ranges are most likely to be the highest or lowest price, with 11:00 as the only midday alternative. No attempt was made to determine whether a high at the open had a low at 11:00 or at the close, nor was any relative positioning of the highlow observed. Separate charts of only highs and only lows proved that there was no distinction in the patternshighs were just as likely to occur at the three peaks as were lows.

There are simple ways in which this small piece of information could be of advantage. After the opening range has been formed, watch for the breakout of the range and assume the other direction is a high or low. In the example, the breakout will occur to the upside, and the bottom of the range will be considered the daily low. Buy the opening breakout

TABLE 155 Likelihood of Movement in the Same Direction as the Open

	<i>Cases</i>			
	(1)	(2)	(3)	(4)
Open—9:20	39%	—	—	—
9:20—10:00	52%	57%	58%	50%
10:00—11:00	43%	40%	35%	48%
9:00—11:00	45%	47%	43%	48%
9:20—12:00	43%	49%	43%	44%
12:00—Close	46%	53%	48%	42%

FIGURE 154 Combined occurrence of highs and lows.



with a stop below the opening range. Look for the high of the day at 11:00. If there is a test of the highs at 11:00, liquidate the position assuming that the resistance will hold. If there is another upside breakout, buy again in anticipation of the highs of the day at the close. If no test of the highs occurs at 11:00, hold the position until the close; if support is broken, close out or reverse and expect the lows of the day at the close.

A Recent Look at the Timing of Intraday Highs and Lows

Since the timing of cattle was studied more than 20 years ago, we might expect the frequency of occurrence of highs and lows to have changed, but that is not so. The first 15 minutes of the day still account for a large percentage of the highs and lows, and the closing 15 minutes is the next most likely time, and somewhere around the middle of the day is the third most popular. But this is primarily a domestic market, compared with Eurodollars or the S&P 500, which attracts a significant world participation. In the case of currencies, most trading begins when the London markets open, at about 2:00 A.M., Chicago time, about 5 hours ahead of the CME's International Monetary Market open. By the time the United States makes its first trade, prices could have moved far from the previous U.S. settlement based on a halfday of business activity in Europe, and a gap opening simply puts U.S. prices in line with the rest of the world.

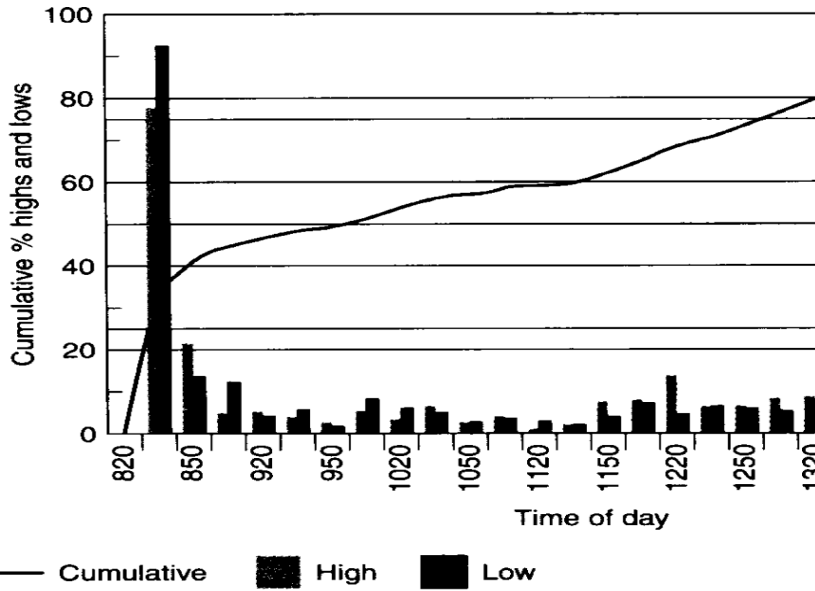
it should not be a surprise if price patterns have changed during the globalization of the past 10 years. With data more readily available, a

selection of major markets could be sampled for 15minute intervals and plotted to show the distribution of highs, lows, and the cumulative combination of highs and lows (see Figure 155) for the 3year period from March 1992 through February 1994. The results are very similar although the markets are

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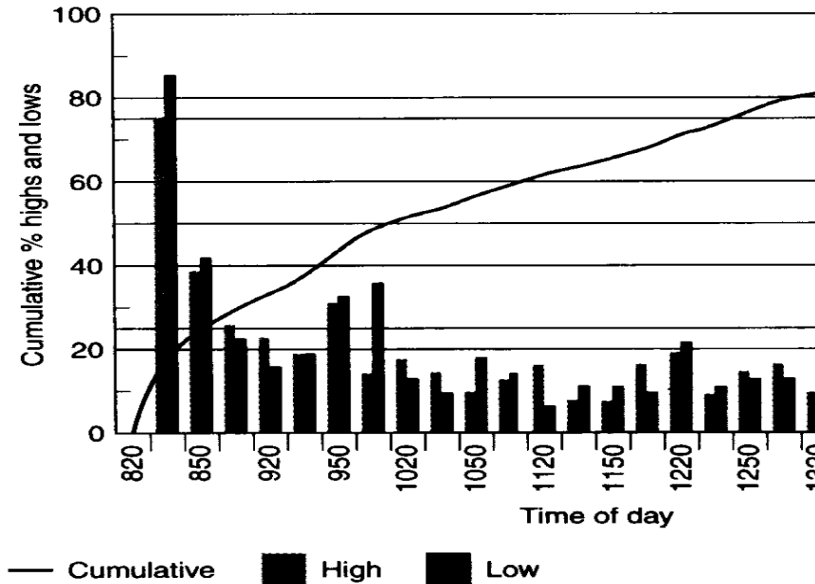
FIGURE 155 Intraday distribution of highs and lows. (a) Eurodollars. (b) Japanese yen.
(c) Deutschemarks. (d) U.S.Treasury bonds. (e) S&P 500. (f) Coffee.

15-minute Eurodollar (Mar 92–Feb 93)



(a)

15-minute Japanese yen (Mar 92–Feb 93)



(b)

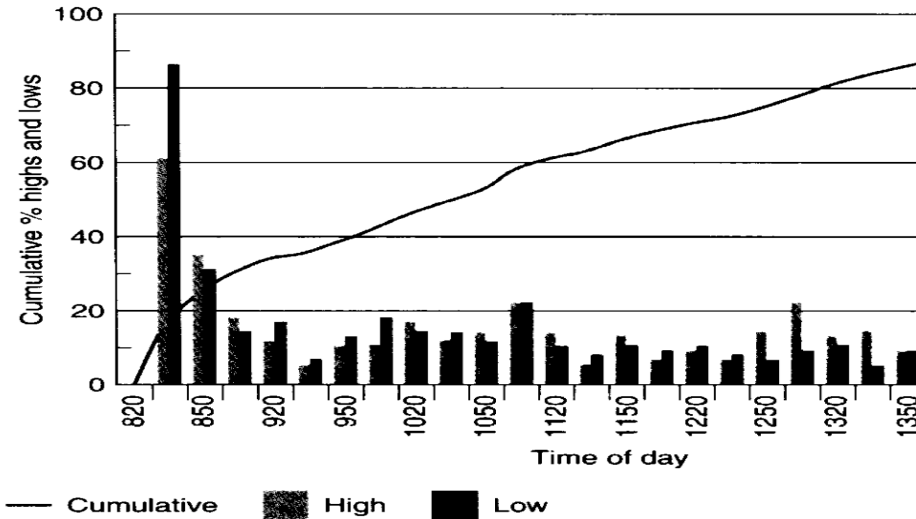
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FIGURE 155 (Continued)

15-minute Deutschmark (Mar 92–Feb 93)

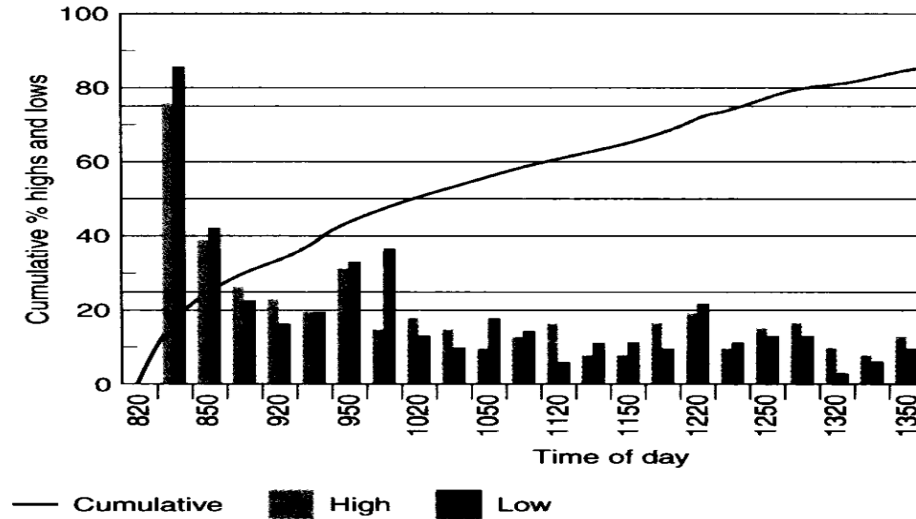
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15-minute Deutschemark (Mar 92–Feb 92)



(c)

15-minute U.S. bonds (Mar 92–Feb 94)



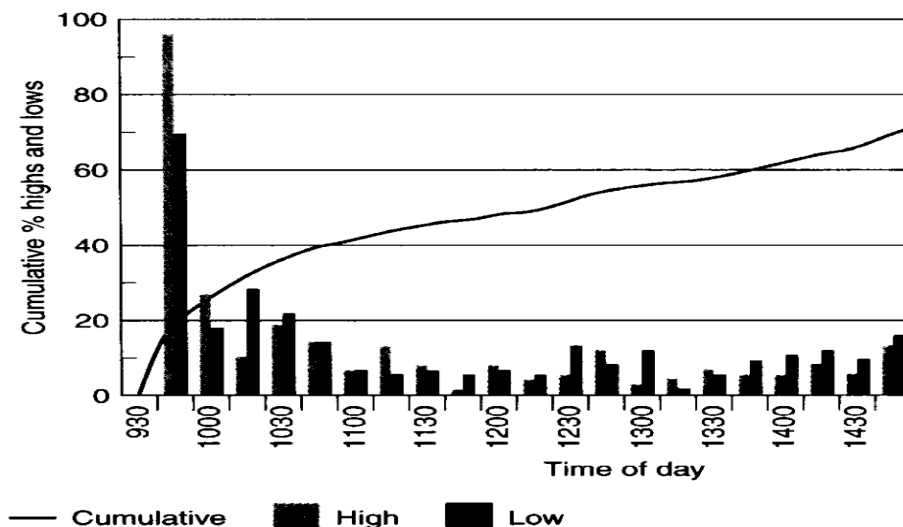
(d)

quite different. They are also remarkably close to the pattern seen in 1976 cattle, except that the end of day is not as pronounced in the recent period.

In general, 25% to 40% of all highs and lows occur in the first 15 minutes of trading. Afterward, there seems to be an equal chance of a high or low occurring throughout the day. If we look closer, we can see a slightly larger increase just after 12:00 on most charts,

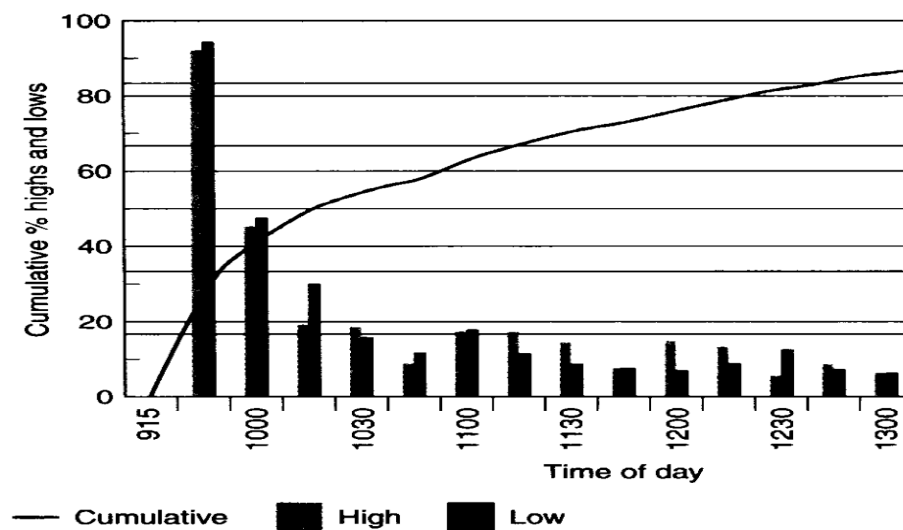
FIGURE 155 (Continued)

15-minute S&P 500 (Mar 92–Feb 94)



(e)

15-minute coffee 'C' (Mar 92–Feb 94)



(f)

and an additional increase in the frequency of highs and lows near the close. Eurodollars show the greatest chance of a high or a low occurring at the open, while coffee has the same 40% chance over the first 1 hour, 45 minutes of trading. The S&P futures makes 25% of its highs and lows in the last 1 hour, 15 minutes of trading, with 10% after the New York Stock Exchange closes at 3:00 P.m.

Trading Decisions

For markets such as the Deutschmark, which has a steady chance of posting a new high or low anytime after the first 15 minutes (remember that this interval includes any reaction to U.S. economic data that is released 10 minutes after the open), trading could be approached by deciding, after 15 minutes, whether the market has already made a high or a low for the day. For example, if an economic report indicates a weak dollar, and the price of the Dmark jumps 50 ticks, we could reasonably assume that we have seen the lows of the day. If prices make a new high during the next 15 minutes, we are even more likely to have seen the lows in the first 15 minutes. It is possible that we have seen both the lows and the highs, but it is the lows only that occurred at the most common time. If we assume that the high can occur anytime during the day, then buying sooner will give more opportunity to profit by the end of the day.

You can increase the confidence in your decision by waiting about 2 hours into the trading day, when most markets have a 50% chance of seeing a high or a low already established. While this may make it easier to identify the correct extreme, it reduces the opportunity for profit by the end of the trading day. A projection of volatility, which can be reasonably constant for many markets, could help decide whether there is enough opportunity to enter a trade.

OPENING GAPS AND INTRADAY PATTERNS

The daily price fluctuations and intraday patterns of a market may be related to the strength or weakness of the daily opening. A large gap opening implies greater volatility for the day, positions prices for a greater reaction, and may show more consistency in the subsequent intraday patterns than a market that opens nearly unchanged. A gap analysis was performed to study the combination of patterns that could be traded profitably. A strong open followed by a stronger close would allow a trader to buy on a pullback after the open, while a consistently weak close after a strong open would be an opportunity to set a short position. Specific entry timing can be improved by using the patterns discussed in the previous section.

The gap analyses for the six diverse markets shown in Table 156 are separated into two parts:

1. The position of the closing price following a gap opening.
 - a. The close continued (extended the move) in the direction of the gap.
 - b. The close was between the gap opening and the prior close.
 - c. The close reversed the direction of the opening gap (that is, if the open